

U.S. Environmental Protection Agency
Science Advisory Board
Radiation Advisory Committee

Summary Minutes of Public Meeting¹
November 16-18, 1999

Committee: Radiation Advisory Committee (RAC) of the U.S. Environmental Protection Agency's Science Advisory Board (SAB). (See Roster - Attachment A.)

Date and Time: Tuesday, November 16 through Thursday, November 18, 1999 (See Federal Register Notice - Attachment B).

Location: This public meeting was held in the Science Advisory Board Conference Room, 6013 Ariel Rios Building, 1200 Pennsylvania Avenue, NW, US EPA Headquarters, Washington, DC 20004.

Purpose: The purpose of the meeting was for the RAC to: (a) conduct a review of the risk assessment of radon in homes in light of the National Academy of Sciences (NAS) Biological Effects of Ionizing Radiation (BEIR VI) report. Specifically, the RAC was asked to review the Office of Radiation and Indoor Air (ORIA) draft document titled "Assessment of Risks from Radon in Homes," dated October, 1999 (See Attachment E-7); b) discuss and plan for the next RAC meeting; c) briefly discuss additional projects planned for review in the balance of Fiscal Year 2000 and other projects as time permits; and d) receive an informational briefing and update on the Office of Water (OW) proposed regulation on radon in drinking water. (See Final Meeting Agenda - Attachment C).

Overview of Accomplishments: On Tuesday, November 16, 1999 the RAC welcomed new members and consultants, thanked departing members, began review of the assessment of risks from radon in homes (See Attachment E-7), and began a writing session on this review topic (See RAC comments in Attachment F, as well as the draft report prepared during the meeting in Attachment I). The ORIA draft document reviewed is titled "Assessment of Risks from Radon in Homes," dated October, 1999 (See Attachment E-7). The charge questions to the RAC for the review are as follows (See Attachment E-6):

- a) Are the methodology and overall approach for assessing risks from radon in
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¹ NOTE AND DISCLAIMER: The minutes of this public meeting reflect diverse ideas and suggestions offered by the SAB/RAC members and consultants (M/C) to the Agency during the course of deliberations within the meeting. Such ideas, suggestions and deliberations do not necessarily reflect definitive consensus advice from the RAC M/C. The reader is cautioned to not rely on the minutes to represent final, approved, consensus advice and recommendations offered to the Agency. Such advice and recommendations may be found in the final advisories, commentaries, letters, or reports prepared and transmitted to the EPA Administrator following the public meetings.

- homes adequate?;
- b) Are the assumptions behind the calculations appropriate?; and
- c) Have the limitations and uncertainties in the assessment been adequately described?

On Wednesday, November 17, 1999 the RAC M/C 1) presented Dr. Stephen L. Brown, the departing Chair of the RAC, with awards and recognition for his long-standing service to the SAB, as well as completion of his two-year term as Chair of the RAC; 2) received an introduction to the SAB's Discussion Data Base (DDB) by Ms. Angela Nugent of the SAB staff, who also provided background papers on social sciences topics (See Attachments S-3, S-4, and S-5). Copies were left on the handouts table for interested individuals; 3) met with the ORIA Staff Director, Mr. Stephen D. Page to discuss past and upcoming reviews; 4) discussed the proposed FY 2000 project sheets that have been formally submitted to the SAB as well as the proposed self-initiated projects (See Attachments E-10 and E-11), and 5) continued the writing session on review of the assessment of risks from radon in homes.

On Thursday, November 18, 1999 the RAC M/C 1) selected dates and discussed likely topics for upcoming FY 2000 RAC meetings; 2) outlined a planned schedule of deliverables to complete the radon risk review; 3) discussed various FY 2000 proposed projects, including possible self-initiated projects, 4) received a briefing and update by the EPA Office of Water (OW) staff on the proposed radon in drinking water regulation; 5) continued edits to the draft radon in homes risk review; and 6) debriefed the ORIA staff on the substance of their preliminary responses to the charge questions and other recommendations.

Attendees: Committee members and consultants: Dr. Janet Johnson, RAC Chair (Days 1,2&3), Dr. Stephen L. Brown, past RAC Chair (days # 1,2&3); Dr. Richard Bull (day #2); Dr. Giles Bussod (days 1,2 &3); Dr. Thomas F. Gesell (days #1,2 &3); Dr. David Hoel, member of the SAB's Environmental Health Committee (EHC) Liaison (days 1&2); Dr. Bobby R. Scott (days 1,2 &3); Dr. K. Jack Kooyoomjian (Designated Federal Officer - SAB Staff, days #1,2 &3); Dr. Ellen Mangione, M.D. (days #1,2 &3); Dr. Jill Lipoti (days #1,2 &3); Dr. Genevieve S. Roessler, (days #1,2 &3), Dr. Bobby R. Scott (days 1,2 &3) (See Meeting Sign-In Sheets for Attendees - Attachment D.)

Environmental Protection Agency Participants: Dr. Donald G. Barnes (SAB Staff, day #1, 2&3 present during portions of each day); Ms. Nancy Hwa Chiu (OW) (day #3); Dr. Mary E. Clark (ORIA); (days #1, 2&3); Dr. Jack Fowle, SAB staff (day #2 was present during portion of the meeting); Mr. Dale Hoffmeyer, ORIA (day #2); Mr. Phil Jalbert, IED (6609-J) (day #1); Mr. William (Bill) Labiosa, (OW) (day #3); Ms. Sylvia Malm, OW/OGWDW (day #3); Mr. Thomas Miller, SAB Staff (day #3); Mr. Christopher Nelson (ORIA) (days #1, 2&3); Dr. Angela Nugent (day #2); Mr. Stephen Page, ORIA Director (day #2); Dr. David Pawel (ORIA) (days # 1, 2&3) ; Dr. Jerome S. Puskin (ORIA) (days #1, 2&3); Ms. Anita Schmidt (ORIA) (day #1&3); Mr. James Taft ,OW/OGWDW (day #3); Dr. Anthony Wolbarst (day #2); (See Meeting Sign-In Sheets for Attendees - Attachment D.)

Other Participants from the Public: Mr. Marc Messing, National Radon Safety Board (days #1,2 &3); Dr. Gary Kayajian (Representing self) (day #1 only); Mr. Alan Roberson, AWWA, (day #1); Ms. Denise Springborg, New England Interstate Water Pollution Control Commission (day #3); Mr. Lorin Steiff, Rad Elec., Inc.; (day #1, 2&3); (See Meeting Sign-In Sheets for other

Attendees - Attachment D).

NOTE: Dr. Karl Martin of the PreCura Institute for Preventive Medicine in Germany formally requested an opportunity to present information pertaining to high residential health effects of indoor radon exposure in Saxony (the Schneeberg Study), but was ill and could not attend. He provided comments in written form (See Attachments G1 - G5).

RAC M/C Invited but Not Attending the Meeting: Dr. William J. Bair, outgoing member, went off on an exotic trip with his wife (See Dr. Bair's letter as Attachment S-1). Dr. John Poston, RAC member, and Dr. Richard Hornung, Consultant to the RAC, were invited, but could not attend due to illness. New RAC members, Drs. Lynn Anspaugh and Bruce Boecker were unable to attend, due to prior commitments to conduct radionuclide-related business in Russia.

Meeting Summary:

The meeting followed the issues and general timing as presented in the Agenda, except where otherwise noted (see Meeting Agenda - Attachment C). Formal written public comments were submitted to the Committee by Dr. Karl Martin of the PreCura Institute for Preventive Medicine, but did not arrive until after the meeting adjourned (See Attachments G-1 to G-5).

Summary of Meeting: Day #1:

Welcome and Introductions: Dr. Stephen L. Brown, outgoing Chair of the RAC, opened the meeting at 9:00 a.m, and passed the meeting promptly over to Dr. Janet (Jan) Johnson, the new Chair. Departing members were recognized and new members and consultants were welcomed. Dr. Johnson opened with welcoming remarks to all the members and consultants and outlined the conflict of interest disclosure process. She asked that as the members/consultants (M/C) introduce themselves, they also follow the protocol for the voluntary disclosure process (See Attachment C-1). Dr. K. Jack Kooyoomjian, Designated Federal Officer (DFO) for the RAC, provided brief instructions for the disclosure process mainly for the benefit of any new RAC M/C and members of the public not familiar with the procedures. He also noted the materials which had been provided to the Committee and noted that a complete set of materials was available on the hand-out table, along with copies of handouts provided by the Office of Radiation and Indoor Air (ORIA) for the presentations which were to take place during the meeting. He requested that panel members introduce themselves and make a voluntary disclosure statement for the record regarding their research interests and experiences, including any public pronouncements made and relationship of their organizations to the review topic of radon risk. None of the disclosures identified any "particular matter" which would conflict with or compromise any RAC M/C participation at the public meeting.

Dr. Johnson had the ORIA staff and other participants, guests and the public introduce themselves. Dr. Kooyoomjian briefly conveyed information pertaining to meeting logistics. He also presented Dr. Bair's letter (See Attachment S-1), thanking the Agency for the opportunity to serve on the SAB's RAC these past six years, as well as presenting very unique hand-made gavel for use by all RAC Chairs at future RAC meetings. The letter had the details of how the gavel was made and where the various parts came from. This gavel was formally received by Dr. Jan Johnson, and passed around the room to the RAC M/C to admire.

Introduction to Review of the Assessment of Risks from Radon in Homes: (Item II on Agenda):

At 9:45 a.m., Dr. Mary Clark introduced the topic, noting that the Agency had recently responded to the RAC's advisory on this particular topic (See Attachment L). She noted some highlights of the changes, such as the addition of a discussion of years of lost life expectancy, and re-capped some of the issues. She then introduced Dr. David Pawel, who began the ORIA staff presentation (See presentation entitled "EPA Assessment of Risks from Radon in Homes, Attachment H). Dr. Pawel introduced the relative risk models, gave a brief overview of the life table methods, and presented an overview of the EPA and the BEIR VI assumptions. He discussed the etiologic versus excess risk concepts, the sensitivity analysis, the effects of smoking, and the baseline lung cancer rates.

In the discussion that followed, the Committee members brought up actual case studies and research on modeling of radiation effects. The Committee suggested that the Agency should not have restricted itself to the BEIR VI models, and encouraged the Agency to consider biologically-based models. While the program office staff sensed that the current biologically-based models alone do not adequately address the issues, the Committee believed that such models are worth looking at.

Presentations on Review of the Assessment of Risks from Radon in Homes: (Item III on Agenda):

At 10:55 a.m., Dr. Puskin of ORIA discussed the sources of uncertainty with respect to BEIR VI. Topics covered included exposure of uranium miners to diesel fumes and dust containing silica and arsenic as confounders (See Attachment H). He noted specifically the effects of arsenic in the Chinese tin miners. Other sources of uncertainty include the shape of the exposure and exposure rate response functions, the temporal expression of risks, the dependence of risks on gender, age at exposure, and smoking status. There are additional uncertainties relating to background exposures and demographics. Dr. Puskin noted that essentially all measurements on variations in K were derived from data in a few houses. Uranium miners were exposed to radon in their homes, as well as in the mines.

The concentration and duration models were discussed, in particular the effect of cut-point selection on the models and how the differences arise from the way cuts are made in the data. The RAC M/C observed that the biological explanations are simply not there. The RAC M/C also discussed the parameter distributions and results of the Monte Carlo simulation.

At 11:22 a.m., Dr. David Pawel discussed the sensitivity analysis, commenting on the examination of uncertainties related to four (4) parameters: the proportion of youth under 18 years of age that will eventually smoke, the risk coefficient ratio for non smokers, the relative risk for all lung cancer deaths, and the risk coefficient ratio for children. A question and answer session followed covering a number of issues including what the BEIR VI Committee did or did not consider in its analysis, the errors in the miner exposure estimates and variability that exists among the studies, the leukemia and non-leukemia effects, the results from published versus ad hoc models, the role of smoking status, the effect of changed data sets on the model, how far

the Monte Carlo simulation extends in time, and other related issues.

The Committee took a lunch break from 12:25 p.m. to 1:35 p.m..

Mr. Chris Nelson gave a presentation on background exposure considerations (See briefing entitled "EPA Assessment of Risks from Radon in Homes," See Attachment H). He noted that parameter values for the BEIR VI risk models were derived for excess risks relative to baseline rates for miners without consideration of their non-occupational exposure. He observed that the EPA assessments principally focused on risks due to residential exposures at or near background levels. To be consistent with the BEIR VI model formulation, EPA is proposing to apply its relative risk model to U.S. baseline lung cancer data with no background exposure correction. He described the implications of this approach, namely that the BEIR VI models can be used in a consistent manner to calculate risks due to radon exposures without having to adjust the baseline for background radon. The methods used in the derivation of the BEIR VI models lead to some uncertainty as to what, if any, adjustment should be used in applying them for a given background exposure level.

A question and answer session followed Mr. Nelson's presentation. The Committee recognized that the main thrust is to calculate risk of background. An open discussion followed. Questions, such as what was the basis for assuming 2 times the basis for the miners followed.

IV. PUBLIC COMMENTS:

Dr. Johnson called for public comments at 2:40 p.m. and none were offered at this time, so the Committee took a break from 2:43 p.m. to 3:00 p.m..

NOTE: Dr. Karl Martin of the PreCura Institute for Preventive Medicine in Germany had formally asked to provide comments (See Attachment G-1) on high residential radon health effects in Saxony (Schneeberg Study), but was ill and could not attend the meeting. However, he mailed material to Dr. Kooyoomjian, but it arrived On 11/22/99 (after the meeting was held). Dr. Kooyoomjian mailed these materials to the Committee for their review (See Attachments G-3, G-4, and G-5).

Writing Session (See Item V on Agenda): Round-the-Table Suggestions: Round 1:

At 3:00 p.m., a writing session followed the presentations. Dr. Johnson and the Committee asked Dr. Mary E. Clark when ORIA staff would need the report and in what form it would be most useful. Dr. Clark responded that if the public (consensus) draft were available in early February, that would be most helpful for the staff to begin responding to the most important advice. The Committee then proceeded to solicit feedback from its M/C on the most important issues in a round-the-table format. Some of the issues identified in the discussion is summarized in the text that follows:

The need to recognize and incorporate biological models was discussed, as well as the need to recognize uncertainty in exposure and lung cancer risk estimates in miner studies. There is uncertainty both in the models and in the exposure estimates. The Committee recommended that the Agency document should include a risk characterization summary, and should make clear to the reader whether there are new risk data behind the models. Are the

risks really 2 times greater? The discussion in the draft document should be expanded to provide the rationale.

The Committee commented that the Agency was responsive to the earlier advice, but now that they've done it, they were not sure that they liked it! The Committee made a number of suggestions to improve the presentation of the results, including recommendations for the sensitivity analysis, such as "childhood risk coefficients." Suggestions were also made to continue to strive to make the logic transparent to the reader, to provide more supporting documentation and to explain the intended uses of the draft document, noting that there is a danger of using central estimates of risk without describing the associated uncertainties. Suggestions were made on many points on uncertainties and the limitations based on the different models. For instance, it should be recognized that there is parameter inter-dependence in the sensitivity analysis, with a variation that is properly known to occur.

Writing Session (See Item V on Agenda): Round-the-Table Suggestions: Round 2:

Additional issues were raised, such as adjusting the central values, double-checking cigarette smoking prevalence for the next generation (because it seemed too high), looking at specific population mix information and not just applying general U.S. coefficients, as well as the need for more smoking, age, gender and other specific information in future applications. Questions were also raised on radiation and non-radiation related cancers.

Dr. Johnson summarized the issues, and the Committee took on writing assignments pertaining to the charge. There being no additional business for the day, the Committee adjourned at 5:00 p.m..

Summary of Meeting: Day #2:

Introduction and Welcome:(Item VII on Agenda):

Dr. Johnson made brief opening remarks and introductions, recapping the previous day's accomplishments. She introduced Mr. Stephen D. Page, Director of the Office of Radiation and Indoor Air (ORIA), who commented on the importance of science within the Agency and particularly the value added with the ORIA and RAC interactions over the years. (This discussion with Mr. Page was a hoped for item, but was not formally listed on the Agenda, because of the possibility that he could be called away at the last minute.)

ORIA Staff Director Visit and Discussion with the RAC: Mr. Page highlighted the significance of recent work with the SAB's RAC. Notably, he touched upon the SAB/RAC timely review of the Federal Guidance 13, Part 1 report, the importance of the two ERAMS advisories, the recent Low Level Mixed (radioactive) Waste advisory and the subsequent OMB review of this topic. He also commented on the significance of the Multi-Agency Site Survey and Investigation Manual (MARSSIM) review, the need for review of the upcoming Modeling of Atmospheric Releases of Radionuclides, as well as the upcoming reviews on Technologically-Enhanced Naturally-Occurring Radioactive material (TENORM) and Multi-Agency Radionuclide Laboratory Analytical Protocols (MARLAP). A lively question and answer session followed. Issues raised included a concern for data quality if privatization occurs at the laboratories, and a comment that the International Scientific Committee on Radiation Standards (ISCORS) could be more useful if

there is more ORIA/EPA interaction. The Committee members expressed their appreciation to Mr. Page for spending quality time with them at this meeting and for touching base, as well as sharing his thoughts on the importance of science advice in the overall process.

Presentations and “Thank You’s” to Dr. Brown: The discussion with Mr. Page was followed by presentation of a plaque by Dr. Barnes, Staff Director of the SAB, to Dr. Stephen Brown for his service to the SAB as RAC Chair these past two years. He commented that Dr. Brown is still on the Research Strategies Advisory Committee (RSAC). This was followed by a presentation of an engraved clock to Dr. Brown as an appreciation from the DFO, Dr. Kooyoomjian and the Management Assistant, Ms. Diana Pozun.

SAB Discussion Data Base (DDB): (See Agenda Item VIII): Ms. Angela Nugent made a brief presentation on the SAB’s Discussion Data Base (DDB) (See Attachment S-3). She described how it can be used as a tool to aid reviews (see Agenda Item VIII). The Committee discussed the possible uses of this tool; they decided that they would use this tool as opportunities arose; and they decided to try it on the radon risk review activity. They took a break at 10:15 a.m., reconvening at 10:42 a.m.

Update on Federal Guidance 13, Part 1: After the break, Mr. Christopher Nelson of ORIA gave an update on Federal Guidance 13, Part 1 (See Attachment N fact sheet). He noted that it now has 800 radionuclides, instead of 100, the uncertainty discussion has been expanded (the uncertainty appendix is now approximately 38 pages in length), the risk coefficients are tabulated, the subjective judgements are by range categories, there is an expanded discussion on threshold issues, the ISCORS folks looked at the pre-publication copy, and many more “factoids.” He noted that the most daunting task was the uncertainty writeup, and that some of the reference materials are now published in the open, peer-reviewed literature.

Discussion of the Proposed FY 2000 Project Sheets that have been formally submitted to the SAB: (See Agenda Item X and Attachments E-10 and E-11):

At 10:51 a.m., Dr. Mary Clark, Associate Director of ORIA, discussed the proposed Fiscal Year 2000 review topics, which are briefly summarized as follows:

TENORM Advisory - The program office staff needs more time to sort through a series of waste streams (uranium mining, phosphate, etc.). The TENORM Advisory is currently scheduled for the RAC’s spring meeting. ORIA intends to ask the RAC such basic questions as: Are we sure this is the right approach? It was clear that ORIA believes that they could benefit from an advisory on directions taken and overall approach early-on in this process. Uranium mining provides one example of the approach taken, which should be one of the first items for the RAC to look at in some detail.

In the Q&A that followed, the RAC asked if TENORM is restricted to waste, and the comment was noted that it may be a good way to get started.

GENII Version 2 Advisory - Dale Hoffmeyer of ORIA gave a briefing on this computer code at 1:25 p.m. (See Attachment M). The acronym, GENII stands for GENEration II of the Hanford Environmental Dosimetry Software System. It was developed by Bruce

Napier and Dennis Strange of Batelle PNW Labs, and runs on a Windows 98 platform. A Q&A followed on the models area, including such questions as: Is this similar to or does it incorporate a version of RESRAD?; What versions it does or does not include?; Are the terrestrial models similar to PRESTO? (Short Answer: No. Could consider different terrestrial models). It was noted by the RAC M/C that GENII Version 2 sounds similar to the Hanford models, that it does not have the capability to include advective transport, that the SAB/RAC review is considered part of the Q/A process, that the Cal Puff model's complex terrain feature can be compared to GENII Version 2. The RAC also asked whether GENII Version 2 could be used on Nuclear Power Plant Modeling.

Other Topics - The ORIA program staff touched on the need for a briefing on MARLAP, as well as a future possible review of the Technical Document on Sludge pertaining to radionuclides.

Writing and Reading Session on Review of the Assessment of Risks from Radon in Homes: (See Agenda Item XI):

At approximately 2:15 p.m., the Committee discussed the report writing exercise. Issues raised included such topics as the potential for misuse of models, whether the duration model was properly applied in the BEIR VI report, results from Cohen's epidemiologic studies, the preference for use of biological models, a discussion on potential confounders and ambiguities in the draft document pertaining to the miners data, such as silica, silica dust and diesel fumes, other comments beyond the charge and related topics. The discussion included the continuing need to develop a main message of not underestimating uncertainty, the need for developing and displaying user-friendly applications, and the continuing need to be transparent to the reader and provide as much information as possible in the text, as well as in the appendices of the report. A reading, writing and editing session for the draft materials prepared by the Committee followed.

After the writing and reading session, Dr. Johnson outlined what she expected the following day's work (11/18/99) would cover as follows:

TIME	ACTIVITY
9:00 a.m. to 10:30 a.m.	Report Edits
10:30 a.m. to 11:00 a.m.	RAC Planning
11:00 a.m. - 12:00 noon	Water & Radon Briefing
12:15 a.m. - 1:00 p.m.	De-Briefing for ORIA Staff
1:00 p.m. - adjourn	Continued Writing for Those Who Wish to Stay

There being no further business for the day, the Committee adjourned at 5:10 p.m.

Summary of Meeting: Day #3:

Introduction, Opening Remarks, Agenda For the Day and Coordination Issues (Item XIII on Agenda):

Dr. Jan Johnson welcomed everyone at 9:10 a.m. and discussed selecting the review

dates for upcoming RAC meetings. Tentatively, the Committee selected the following dates for the upcoming meetings:

RAC Technical Editing Session: Dec. 10, 1999, 3:00 p.m to 5:00 p.m. (eastern time) - A technical editing (non-FACA) work session to re-write the draft report on radon risk ;

RAC Spring Meeting: April 25-27, 2000 (with April 26-28, 1999, or April 18-20, 2000 as alternate back-up dates);

RAC Summer Meeting: August 1-3, 2000 (with August 8-10, 2000 as alternate date); and

RAC Fall "Kick-Off" Meeting for FY 2001: November 14-16, 2000 (with December 12-14, 2000 as alternate date).

Schedule and Process for Radon Risk Review:: Dr. Johnson committed to having the first draft edits on the radon risk review ready around Nov. 23-24, 1999, and she or Jack Kooyoomjian will post the new draft to the SAB Discussion Data Base (DDB). She plans to attach a draft executive summary and letter to the Administrator in this upcoming draft. She also noted that in the letter to the Administrator the RAC should be more explicit about the choice of model and advice on quantitative uncertainty (not uncertainty in the model). Other issues were discussed regarding individual assignments to Committee M/C. The following schedule was recommended:

DATE	ACTION
Nov. 23-24, 1999	It was recommended that the Committee get all edits following the RAC Nov. 16-18, 1999 public meeting to Drs. Johnson and Kooyoomjian on time for the Nov. 23-24 editing cycle;
Dec. 2 nd	The Committee should respond by December 2 nd to the November 23-24 draft;
Dec. 6 th	Dr. Johnson will post a new draft no later than December 6 th , and this draft would be would be Federal Expressed by Dr. Kooyoomjian and Mrs. Diana Pozun to the Committee for discussions for the December 10 th editing session;
Dec. 10 th	Technical Editing Session to take place 3:00 p.m. to 5:00 p.m (eastern time), and this will be a non-FACA meeting;
January	First Public Draft prepared for closure review by the RAC and distributed to the interested public (including the Agency); and
March or April	To SAB Executive Committee for Vetting Review and Closure

Dr. Clark of ORIA noted that if the RAC could provide a first consensus public draft in February, that would be very helpful to the staff for getting their work done in a timely manner. The RAC M/C felt reasonably comfortable with this schedule.

Discussion on Proposed Self-Initiated Projects: Border Detectors and Orphan Source Contamination of Metals: A discussion followed on proposed self-initiated projects, namely Border Detectors and Orphan Source contamination of metals (See Attachment E-11). State issues regarding medical wastes were also discussed. The problem of monitoring radioactively contaminated items entering the U.S. from our northern (Canada) or southern (Mexico) neighbors was discussed. It was observed that states have lead in the Federal Radiological Emergency Response Plan (FREEP) regarding detection. Other issues were raised, and the discussion lead into Dr. Clark's presentation. During the course of the meeting, the RAC concluded that both self-initiated proposals could be placed on the "back-burner" for now, since there are a number of significant ORIA requests to work on, and while the self-initiated proposals are on-going issues, they do not appear to need immediate attention.

ORIA "Wrap Up" and Summary Discussion on FY 2000 Projects: Dr. Mary Clark summarized the meeting schedule and planned review activities as follows:

Spring Meeting: April 25-27, 2000 (backup dates of April 26-28 or April 18-20):

Advisory on GENII, Version 2,
Advisory on TENORM (Will include general "road map" plus an application with Uranium Mining),
Consultation on Sewage Sludge (Coordination with ISCORS),
Briefing on MARLAP, and
LAMW Response Re-Cap;

Summer Meeting: August 1-3, 2000 (backup date of August 8-10):

Advisory on Approach for Protocol for Dose & Risk for Sewage Sludge Disposal,
Review of GENII Version 2,
Organizing for MARLAP Review in the Fall, and
FY 2001 Projects Discussion;

Fall Meeting: November 14-16, 2000 (Backup date is Dec. 12-14, 2000):

MARLAP Review, and
FY 2001 Project Planning.

A discussion followed the above topics and dates.

Briefing and Update on Radon in Drinking Water Proposed Regulation (See Attachments O through R-5): Before the RAC received an informational briefing and update on this topic, Dr. Johnson had the Committee M/C and guests introduce themselves. She introduced Dr. Richard Bull, Chair of the SAB's Drinking Water Committee (DWC) and Mr. Thomas Miller, DFO for the DWC. She then had the Committee conduct the voluntary disclosure process. In the disclosures that followed, none of the participants had identified any particular matter, or area of conflict-of-interest.

Sylvia Malm of the U.S. EPA Office of Water (OW), Office of Ground Water and Drinking Water (OGWDW), began the briefing (See briefing entitled "Radon in Drinking Water," Presentation to the Radiation Advisory Committee, Science Advisory Board, Nov. 18, 1999, by James Taft, U.S. EPA, OW/OGWDW, Attachment "O"). Ms. Malm touched on the background and overview of the proposed rule, beginning with the 1991 proposal for a Maximum

Contaminant Level (MCL) of 300 pCi/L. She outlined the 1994 Report to Congress which recognized that the highest risk is from radon in indoor air. She also outlined the statutory requirements of the 1996 Safe Drinking Water Act (SDWA), as well as the charge to the National Academy of Sciences (NAS) with respect to assessing the risk of radon in drinking water.

James Taft of OW/OGWDW outlined the key features of the 1999 approach (See Attachment "O"), noting that the rule adopts a multi-media approach as mandated by the SDWA Amendments. He also noted that the rule encourages the states to adopt MCL and Multi-Media Mitigation (MMM) options, and highlighted the unique flexibility in the rule for states to manage radon risk reduction strategies. He outlined the proposed methods and treatment requirements, proposed monitoring requirements, regulatory decision factors, and potential impacts of the radon MCL, as well as the small system rule for facilities serving less than 10,000 people per day. He also outlined the next steps to be taken in this area.

A Q&A session followed and the Committee, with Dr. Bull from the SAB/DWC, touched upon a number of issues, such as requirements for wells, laboratory certification questions, radon mitigation in homes, the use of stakeholder meetings, and other issues.

Dr. Johnson asked if there were public comments on this topic or on any other issues to come before the RAC. None were offered.

The Committee took a lunch break and reconvened for a debriefing to the ORIA staff on the radon in homes review.

Debriefing on Review of the Assessment of Risks from Radon in Homes: Dr. Johnson, Chair of the RAC, began the debriefing with compliments to the ORIA staff pertaining to their response to the RAC's earlier advisory on this topic (See Attachments E-5 and L). She made particular reference to their responsiveness with regard to etiologic fractions and life years remaining.

In this debriefing, Dr. Johnson also noted issues beyond the charge. She stressed that methods used need to be transparent to the user, and that it would be helpful to have derivations appear in the appendix to the report for others to examine and follow. She then proceeded around the table with the RAC M/C who discussed many topics. For instance, they discussed the merits of mortality versus incidence data, and some participants felt that incidence data provided better results. A major concern was also expressed with model uncertainty (a broad concern that the model chosen might not be correct), rather than uncertainty in the models, and that it should be taken seriously in the overall risk assessment.

The Committee asked ORIA to provide a more explicit narrative about model uncertainty, that the models chosen should be accessible and transparent to certain sub-populations and exposure patterns. It was suggested that some up-front narrative about how certain the ORIA staff is regarding the sources of uncertainty and parameter interdependence would be helpful. The Committee suggested that ORIA and other users may also wish to identify circumstances where the model might be inappropriate for use. Also noted was the idea that there is no problem in some instances with leaving the model semi-quantitative with certain estimates, and that the future efforts could focus on dealing with discrepancies and improvements.

Public Comments (See Agenda Item XVIII): At 1:04 p.m. Dr. Johnson asked if there were public comments. None were offered.

NOTE: It should be noted that Dr. Karl Martin of the PreCura Institute for Preventive Medicine in Germany had asked to provide comments on high residential radon health effects in Saxony (Schneeberg Study), but he was ill and could not attend the meeting. However, he mailed material to Dr. Kooyoomjian, who received it after this meeting (Dr. Kooyoomjian received the materials on 11/22/99). These materials were subsequently mailed to the Committee for their review (see Attachments G-3, G-4, and G-5).

At this point, Dr. Johnson called for a 15 minute break. The Committee re-convened at 1:20 p.m. for a work session on editing the 11/18 draft of their Radon Risk Report (See Attachment J-10). The SAB/RAC M/C who stayed for the afternoon work session included Drs. Johnson, Bier, Brown, Bussod, Gesell, Lipoti and Scott.

Closing Comments (See Agenda Item XX): There being no additional business, Dr. Johnson adjourned the meeting at 2:35 p.m.

Action Items:

- 1) Defer Self-Initiated Projects for Now: It was suggested among the Committee members that they defer any activity on the two self-initiated project proposals (Border Detectors and Orphan Source Contamination of Metals), since there appears to be enough on the RAC's plate at this time, and these are not perceived as urgent issues;
- 2) Radon In Homes Risk Review Draft Report: The Committee prepared at least two drafts during the course of the meeting (See Attachments J-9 and J-10) and committed to prepare at least two more drafts prior to the Dec. 10th (3:00 p.m to 5:00 p.m eastern time) Technical Editing Work Session teleconference. The goal is to produce a first public consensus draft no later than early February;
- 3) USE OF SAB DDB and Scheduling the Radon in Homes Draft Report Technical Editing Session for Dec 10th, 3:00 pm - 5:00 pm (Eastern Time): Dr. Kooyoomjian will work with Dr. Johnson to post the Radon Risk Drafts to the SAB Discussion Data Base as appropriate and to make sure that the drafts are transmitted in a timely fashion to the Committee, especially the RAC's planned Dec. 6th draft for the Dec. 10th Technical Editing Teleconference (A non-FACA meeting). The RAC M/C will sign up and register to use the SAB DDB;
- 4) Target Date for Producing First Public Draft of Radon In Homes Draft Report: The Committee will prepare the first public (consensus) draft on or before early February to share with the interested public and the Agency;
- 5) Public Comments on Radon in Homes Issue: Dr. Karl Martin of the PreCura Institute for Preventive Medicine in Germany provided formal written public comments pertaining to high residential radon health effects in Saxony (Schneeberg Study), which were received after the meeting. Dr. Kooyoomjian

provided these to the RAC M/C for further consideration;

- 6) Upcoming Meeting Schedule: The Committee planned out their Spring, Summer and Fall meeting dates, identified possible back-up dates, and tentatively identified topics likely to come before the RAC. Tentative dates and topics are listed as follows:

Spring Meeting: April 25-27, 2000 (backup dates of April 26-28 or April 18-20):
Advisory on GENII, Version 2,
Advisory on TENORM (Will include general "road map" plus an application with Uranium Mining),
Consultation on Sewage Sludge (Coordination with ISCORS),
Briefing on MARLAP, and
LAMW Response Re-Cap;

Summer Meeting: August 1-3, 2000 (backup date of August 8-10):
Advisory on Approach for Protocol for Dose & Risk for Sewage Sludge Disposal,
Review of GENII Version 2,
Organizing for MARLAP Review in the Fall, and
FY 2001 Projects Discussion;

Fall Meeting: November 14-16, 2000 (Backup date is Dec. 12-14, 2000):
MARLAP Review, and
FY 2001 Project Planning.

- 7) Followup to the Briefing and Update to the Radon in Drinking Water Proposed Regulation: While the RAC M/C, along with the DWC Chair, Dr. Bull had a productive dialogue with the Agency's Office of Water (OW) staff on this topic, and while there are many issues that could be explored, it was sense of the participants that the Science Advisory Board and its various standing Committees (RAC, DWC, EEC, EHC, IHEC, SAB Executive Committee and others) had provided ample advice over the years on the topical area of radon on numerous (over twenty) occasions, and that the SAB would probably be wise to defer at this time from engaging in this particular exercise. Dr. Johnson will coordinate with Dr. Bull and the SAB Executive Committee on any further communications on this topic.

Respectfully Submitted:

Certified as True:

Kooyoomjian, Ph.D. Date
Designated Federal Officer

Janet Johnson, Ph.D., Chair Date
Radiation Advisory Committee

K. Jack

NOTE: Original Signed
KJK

2/3/00

Original Signed
JAJ

2/9/00

LIST OF ATTACHMENTS

<u>ATTACHMENT</u>	<u>DESCRIPTION</u>
A	RAC Roster
B	Federal Register Notice, dated Oct. 25, 1999 (Vol. 64, No. 205, pp. 57452-57455)
C	Final Meeting Agenda dated November 15, 1999
C-1	Guidelines for Public Disclosure at SAB Meetings
D	Meeting Sign-In Sheets:
D-1	November 16, 1999,
D-2	November 17, 1999, and
D-3	November 18, 1999
E	Meeting Folder Contents List Containing Mailings to the RAC Dated October 18, 1999 entitled as follows:
E-1	1) October 18, 1999 Cover Memo from Jack Kooyoomjian to the RAC M/C entitled "Transmittal of Review and Informational Materials Pertaining to the Radiation Advisory Committee's Public Meeting of November 16-18, 1999 for the Assessment of Risks from Radon in Homes, a 'Thank You' to Our Departing Members, A Hearty Welcome to Our New Members and Consultants, and Announcement of Our New Address,"
E-2	2) RAC Roster dated Oct., 1999,
E-3	3) A draft <u>Federal Register</u> notice excerpt for RAC meeting,
E-4	4) Proposed Agenda, dated October 1, 1999,
E-5	5) An Advisory: Assessing Risks from Indoor Radon (EPA-SAB-RAC-ADV-99-010, dated July 14, 1999),
E-6	6) The Request for Review Memo Dated Oct. 12, 1999 from Stephen D. Page, Director, ORIA to Dr. Donald G. Barnes, Director, SAB Entitled "Review of EPA's Draft Assessment of Risks from Radon in Homes," and
E-7	7) The ORIA Draft Report for SAB Review Entitled "EPA Assessment from Radon in Homes," October, 1999,
E-8	8) Article by Jay H. Lubin entitled "The Influence of Residential Radon Exposure on the Estimation of Exposure-Response Trends for Lung Cancer in Underground Miners Exposed to Radon," <u>Radiation Research</u> , 150, 259-261, 1998,
E-9	9) Radiological Protection Bulletin No. 204, entitled "Radon Dreams," by Jon Miles, National Radiological Protection Board, August, 1998
E-10	10) Proposed SAB Projects for FY2000, (FY2000(a) project list.xls), 10/12/99
E-11	11) Retransmittal of July 29, 1999 Memo from K. Jack Kooyoomjian to RAC M/C entitled "Transmittal of Fiscal Year 2000 Proposed Project Sheets, Miscellaneous Informational materials, and Request for Availability for Meetings in FY 2000," (Contains Proposed FY 2000 Project Sheets for RAC and Related Committees)

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<u>ATTACHMENT</u>	<u>DESCRIPTION</u>
F	RAC Comments on Radon Risk Review:
F-1	1) E-mail note from Dr. Janet Johnson to RAC entitled "SAB RAC Radon Risk Review," dated Nov. 8, 1999
F-2	2) Comments from Dr. Ellen mangione, M.D. thru FAX from Jan Johnson to Diana Pozun entitled "Radon Risk Comments from Ellen Mangione," Nov. 10, 1999 (Includes two newspaper clippings),
F-3	3) Comments form Dr. Jan Johnson entitled "Preliminary Notes on the Draft EPA Assessment of Risks from Radon in Homes," dated 11/7/99,
F-4	4) Comments from Dr. S.L. Brown entitled "Preliminary Comments on Assessment of Risks from Radon in Homes," dated October 29, 1999,
F-5	5) Comments from Dr. F. Owen Hoffman, SENES Oak Ridge, entitled "Radon in Homes," dated 10/27/99,
F-6	6) Comments from Dr. Rick Hornung entitled "Comments on EPA Radon Risk Assessment," dated 11/15/99
F-7	7) Comments from Dr. Lynn R. Anspaugh on Rn Report, dated 11/12/99, and
F-8	8) Notes from Dr. John W. Poston, Jr. that he will be unable to attend tjhe meeting, due to illness, dated 11/12/99
G	PUBLIC COMMENTS:
G-1	1) Formal Request for Public Comments at RAC Meeting and Request for Info. On RAC Meeting on Radon Risk Issues: (E-mail from Dr. Karl Martin of the PreCura Institute for Preventive Medicine (located in Germany) entitled Radon Risk Review," This E-mail provides a formal request to provide public comments on the radon risk review and note the existence of a study of high residential radon health effects in Saxony, known as the Schneeberg (Snow Mountain) Study. The study (long and short version was provided after the meeting and mailed to the RAC M/C.);
G-2	2) E-mail from Dr. Robert A. Baan, Unit CIE, IARC , Lyon, France (E/mail address: baan@iarc.fr) entitled "IARC Monograph on Ionizing Radiation; Residential Exposure to Radon," dated 11/02/99 . (This is a request for information and to keep in touch on the topic.)
G-3	3) Cover Letter dated Nov. 11, 1999 from Dr. Karl Martin of the PreCura Institute for Preventive Medicine to Dr. Jack Kooyoomjian of the SAB's Radiation Advisory Committee (RAC) to advise that he will be unable to attend the RAC's Non 16-18, 1999 public meeting, and that he has enclosed the results from the Schneeberg Study ;
G-4	4) Summary Report of High Residential Radon Health Effects in Saxony (Schneeberg Study); and

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<u>ATTACHMENT</u>	<u>DESCRIPTION</u>
G-5	Working Paper on High Residential Radon Health Effects in Saxony (Schneeberg Study), September 1999:
H	EPA Assessment of Risks from Radon in Homes, A Presentation to the RAC by Dr. David Pawel, Dr. Jerry Puskin and Mr. Chris Nelson of EPA/ORIA, Nov. 16, 1999
I	Background Exposure Considerations, ORIA Presentation Continued
J	Draft Committee Materials on Radon Risk Report Prepared During RAC Meeting:
J-1	1) Individual RAC Comments on the EPA Draft Assessment of Risks from Radon in Homes, dated 11/16/99,
J-2	2) Individual RAC Comments on the EPA Draft Assessment of Risks from Radon in Homes, dated 11/17/99,
J-3	3) Comments from Dr. Thomas F. Gesell Pertaining to RAC review of draft EPA Assessment of Risks from Radon in Homes, dated 11/16/99,
J-4	4) Comments from Dr. David Hoel during 11/16 thru 11/18/99 RAC Meeting,
J-5	5) Comments from Dr. Jill Lipoti during 11/16 thru 11/18/99 RAC Meeting,
J-5a	5a) Follow-up Comments from Dr. Jill Lipoti during 11/16 thru 11/18/99 RAC Meeting,
J-6	6) Comments from Dr. Bobby R. Scott entitled Review comments for draft "EPA Assessment of Risks from Radon in Homes," dated 11/17/99,
J-7	7) Comments (a new re-write of earlier comments) from Stephen Brown entitled "Preliminary Comments on Assessment of Risks from Radon in Homes," dated 11/17/99,
J-8	8) Comments from Dr. Gilles Y. Bussod entitled Review comments for draft "EPA Assessment of Risks from Radon in Homes," dated 11/17/99
J-9	9) Draft SAB Report (compendium of comments) dated November 16, 1999,
J-10	10) Draft SAB Report (compendium of comments) dated November 18, 1999,
J-11	11) Appendix A - General Comments
K	Background References Pertaining to Radon Risk:
K-1	1) B.R. Scott, "A Mechanistic Model for Neoplastic Transformation of Cells by High LET Radiation and its Implications for Low Dose, Low Dose Rate, Risk Assessment," <u>Radiation Protection Dosimetry</u> , Vol. 72, No. 2, pp. 105-117, 1997, Nuclear Technology Publishing,
K-2	2) H.P. Leenhouts, "Radon-induced lung cancer in smokers and non-smokers: risk implications using a two-mutation carcinogenesis model," <u>Radiat. Environ. Biophys.</u> , 38: 57-71, 1999

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K-3	3) Luebeck, E. Georg, Wolfgang F. Heidenreich, William D. Hazelton, Herwig G. Paretzke, and Suresh H. Moolgavkar, "Biologically Based Analysis of the Data for the Colorado Uranium Miners Cohort: Age, Dose and Dose-Rate Effects," <u>Radiation Research</u> , 152, pp. 339-351, 1999
K-4	4) Goldsmith, John R., "The Residential Radon-Lung Cancer Association in U.S. Counties: A Commentary," <u>Health Physics</u> , Vol. 76, No. 5, May 1999, pp. 553-557
L	Response by EPA Assistant Administrator, Robert Perciasepe, to Advisory on proposed EPA Methodology for Assessing Risks from Indoor Radon Based on BEIR VI: White Paper, October 20, 1999
M	U.S. EPA/ORIA Background Briefing on GENII version 2, Prepared for the Radiation Advisory Committee of the EPA Science Advisory Board, Nov. 17, 1999
N	U.S. EPA Federal Guidance for Radiation Protection, dated 11/17/99
O	Briefing entitled "Radon in Drinking Water," A presentation to the Radiation Advisory Committee, Science Advisory Board, by James Taft (and also presented by ms. Sylvia Malm), U.S. EPA, Office of Ground Water and Drinking Water, November 18, 1999
P	Science Advisory Board Proposed project entitled "Proposed Regulation for Radon in Drinking Water," Prepared by Sylvia Malm, July 16, 1999
Q	Proposed Radon Rule Package (including cover memo from James Taft, Chief, Targeting and Analysis Branch, OGWDW, to Jack Kooyoomjian, SAB, dated Oct. 22, 1999), containing 40 CFR Parts 141 and 142, National Drinking Water Regulations, Radon-222 (434 pages)
R	Radon Related E-mails Pertaining to Proposed Radon in Drinking Water Rule:
R-1	WaterNews for Oct. 21, 1999
R-2	Radon Fact Sheets, transmitted to Jack Kooyoomjian by Nancy Cunningham, dated 10/25/99

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<u>ATTACHMENT</u>	<u>DESCRIPTION</u>
R-3	An E-mail note from Tom Miller, DWC DFO/SAB to James Taft entitled "Proposed Radon in Drinking Water Rule - Reply," dated 10/25/99
R-4	An E-mail note from Dr. S. L. Brown to Jack Kooyoomjian entitled "Proposed Radon in Drinking Water Rule- Reply," dated 10/26/99
R-5	An E-mail note from Tom Miller, DWC DFO/SAB to Don Barnes, Director SAB entitled "Proposed Radon in Drinking Water - Reply," dated 11/05/99
S	Informational Materials:
S-1	Letter from Dr. William J. Bair, outgoing RAC/SAB Member transmitting a hand-made Gavel for the RAC, and expressing his appreciation for the privilege of serving on the RAC these past 6 years
S-2	A communication from Dr. Donald G. Barnes, Staff Director, SAB/U.S.EPA entitled "Science and Decision-Making," dated 11/12/99
S-3	An information sheet prepared by Dr. Angela Nugent, DFO/SAB entitled "SAB Discussion Database," dated 11/2/99
S-4	A memo dated 9/23/99 from Angela Nugent transmitting a social sciences White Paper written by Mark Wamsley, ECO Associate, OSEC/U.S. EPA, entitled "The Social Sciences and Environmental Protection: Experiences and Opportunities at the U.S. EPA ," dated July 1999
S-5	Resources For the Future Discussion Paper 99-06 by Thomas C. Beierle entitled "Public Participation in Environmental Decisions: An Evaluation Framework Using Social Goals, November, 1998
T	DFO Notes:
T-1	DFO Notes of 11/16/99
T-2	DFO Notes of 11/17/99
T-3	DFO Notes of 11/18/99
End of Record	